Well-Rounded Bulls Bring Profit to Cattle Breeders

For years, beef cattle producers have kept track of characteristics of their animals to selectively breed them and improve specific traits, such as growth rate, fat content, or marbling. Unfortunately, selectively breeding to improve one characteristic can lead to undesirable correlated responses, such as reproductive inefficiencies.

Now, geneticists Michael MacNeil, at ARS' Fort Keogh Livestock and Range Research Laboratory in Miles City, Montana, and William Herring, his industry collaborator, have helped producers move beyond simply breeding to improve individual traits. The researchers have set up a program that helps evaluate and rank animals based on multiple traits and select those that have the potential to produce the most profitable offspring.

In the beef cattle industry, breeders record growth traits such as weights at birth, weaning, yearling, and maturity; carcass traits such as lean yield, marbling, and fat content; and reproductive traits such as the age when a female reaches puberty and whether she becomes pregnant each year.

Breed associations take this information, combine it with each animal's genetic tree, and calculate expected progeny differences, or EPDs. The EPDs give producers an estimate of how the future progeny of one animal will compare to those of another animal within the breed, for a specific trait. By comparing EPDs, for example, they would be able to determine that bull A is more likely to produce offspring with greater marbling than bull B.

Breeding for Profit: A Balancing Act

"Until now, producers have been left with the difficult task of combining these EPDs efficiently," says Herring. "They have had to decide whether growth rate is more important than marbling or whether yield grade is more important than weaning weight."

But MacNeil has designed software that estimates the relative economic value of each trait in a stereotypical production system. This information, combined with an animal's EPD data, can be used to estimate that animal's overall genetic profit potential.

Since 1996, Herring has worked with the Angus Sire Alliance and Circle A Angus Ranch in Missouri to rank sires nominated by Angus breeders throughout the United States by their genetic profit potential, using relative economic values that he and MacNeil calculated.

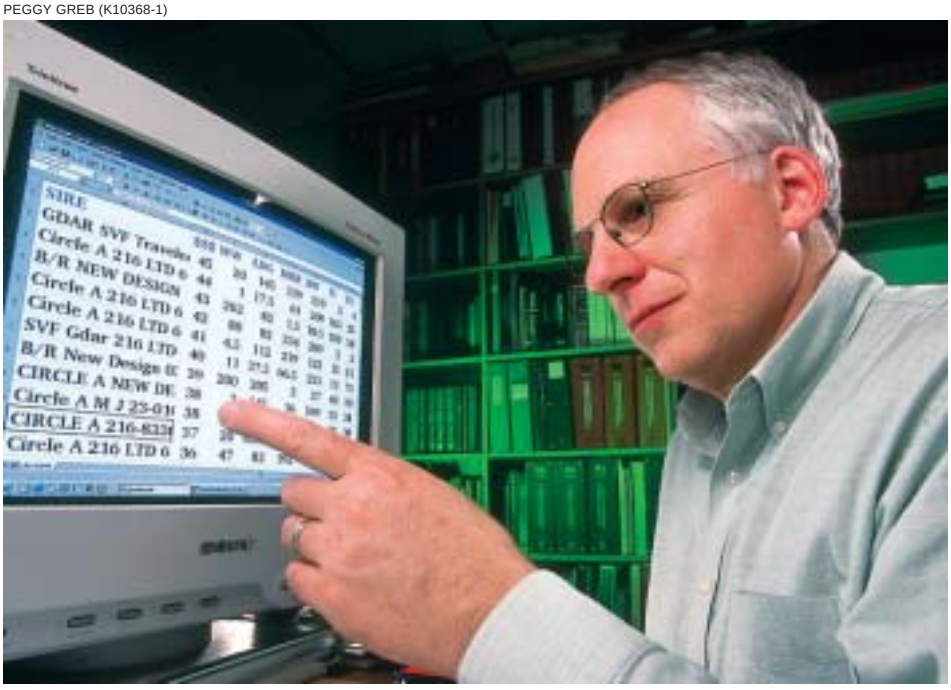
Commercial Angus females at Circle A locations in Huntsville, Iberia, and Stockton, Missouri, are randomly mated to Angus test candidates and reference sires. Data on progeny are then collected, including their birth weight, weaning weight, postweaning daily gain, daily dry-matter intake, marbling score, and yield grade.

The researchers use MacNeil's bioeconomic modeling software to calculate sire rankings. They have found that among the 352 sires tested so far, there exists a range in profitability of $41.65. This means that if the highest and lowest ranking bulls were used in a production system similar to the one described in the economic simulation, a difference in profitability of more than $40 per progeny would be expected.

MacNeil says, "There is no single trait that ensures a bull's offspring will be highly profitable." For example, the marbling rankings of the top five bulls overall range from 1 to 334, and their rankings for yield grade range from 1 to 50. For the other traits, the variability in rank is similar.

ABS Global Inc., based in De Forest, Wisconsin, has leased eight of the top-rated bulls from the Angus Sire Alliance. Doug Frank, an ABS manager, says, "We've been following the alliance since its inception in 1996. We were intrigued by the way data on the animals was being

PEGGY GREB (K10368-1)



Geneticist Michael MacNeil examines results from genetic analysis of sires used in the Angus Sire Alliance program at Circle A Angus Ranch. Economic values for individual traits are used to sort bulls by potential profitability of their offspring. These values are products of ARS research led by MacNeil.

compiled and negotiated the right to lease the top two bulls every year. Testing them takes about 2 years to complete."

In marketing the bulls, ABS publishes their overall profitability EPDs. During an 18-month period between 2001 and 2002, the company sold 75,000 units of the bulls' semen, which was worth more than $1.5 million in retail revenue.

"The alliance bulls are popular because of their multitrait performance," says Frank. "Two of them have been among our top 10 bulls in terms of semen sales."

Based on the results of this research, MacNeil believes that wide differences exist in the profit potential of cattle. He says that producers should be encouraged to use a more comprehensive and objective approach than single-trait selection in choosing how to breed their animals. Bulls that have a desirable balance of traits may, in the end, be much more profitable than those that excel in just one or two traits.—By **Amy Spillman,** formerly with ARS.

This research is part of Food Animal Production, an ARS National Program (#101) described on the World Wide Web at www.nps.ars.usda.gov.

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PEGGY GREB (K10377-1)

Above: Line 1 Hereford bulls enjoy fresh silage on a cold day. These bulls will sire a future generation of calves for seedstock and commercial breeders nationwide.

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Left: This bull, called New Design 9150, is one of the top-ranked bulls for producing profitable progeny in the Angus Sire Alliance. The high rating results from a combination of traits, including outstanding calving ease and overall carcass merit.

Precise Feed Measurement's a Useful Tool

During the fall of 1998, the Circle A Angus Ranch in Huntsville, Missouri, installed a system that allows ranch managers to measure the daily individual feed intake of steers. This system is similar to those in place at research laboratories like ARS' Fort Keogh Livestock and Range Research Laboratory.

Twice a day, a computerized wagon doles out a precise amount of feed into gated bins. Each steer is outfitted with a collar holding a computer chip. When the steer approaches its assigned bin, the chip triggers the gate to open so it can eat; the door closes when the steer walks away. Later, the wagon vacuums up the leftovers and records these amounts.

While geneticist William Herring was working at the University of Florida's North Florida Research and Education Center, the ranchers sent feed intake data and other measurements to him for analysis. Herring measured feed-conversion rates ranging from 4.3 to 8.9 pounds of dry matter intake per pound of gain. Herring is now with NPD (USA) Smithfield Foods, in Roanoke Rapids, North Carolina.

Geneticist Mike MacNeil, of the Fort Keogh laboratory, says, "Improving feed efficiency could help ranchers increase their profits through reduced input costs. This is clearly one of the traits that should be taken into account in evaluating the genetic profit potential of bulls."